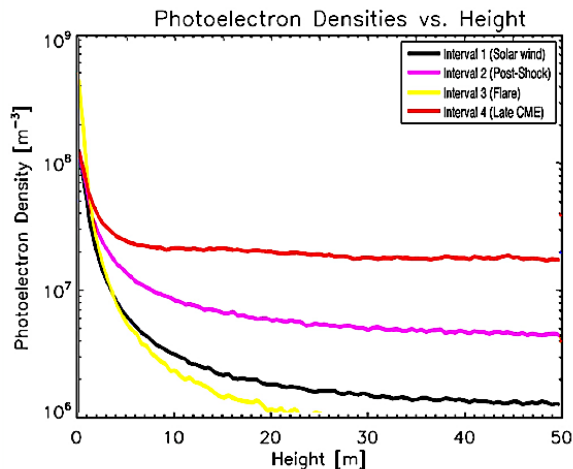


**LUNAR PAYLOAD FOR RADIO WAVE OBSERVATIONS AT THE LUNAR SURFACE OF THE PHOTO-ELECTRON SHEATH (ROLSSES).** R. J. MacDowall<sup>1</sup>, W. M. Farrell<sup>1</sup>, D. Bradley<sup>1</sup>, N. Gopalswamy<sup>1</sup>, M. J. Reiner<sup>2,1</sup>, E. J. Wollack<sup>1</sup>, J. O. Burns<sup>3</sup>, G. Hallinan<sup>4</sup>, A. M. Hegedus<sup>5</sup>, <sup>1</sup>NASA Goddard SFC, <sup>2</sup>Catholic University of America, <sup>3</sup>University of Colorado, <sup>4</sup>California Institute of Technology<sup>5</sup>, University of Michigan. (robert.macdowall@nasa.gov)

**Introduction:** The Radio wave Observations at the Lunar Surface of the photo-Electron Sheath (ROLSSES) instrument will permit determination of the photoelectron sheath density from 0 to ~2 m above the lunar surface. It is a low-frequency radio receiver system to provide radio spectra from 10 kHz - 30 MHz. This has scientific value and is also important to determine the effect on antenna response of lunar radio observatories with antennas on the lunar surface. The data will also include spectra of radio frequency interference from terrestrial transmitters, which is important information to confirm how well a near-side lunar surface-based radio observatory could image solar radio bursts in a frequency range of 0.01 – 30 MHz for the first time. This frequency range corresponds to distances from the Sun of ~1 AU to ~1 solar radius, a very interesting volume of space for future imaging of solar radio bursts, to understand the emission mechanisms better and to enhance their space weather prediction applications. A near-side observatory could also be built to image synchrotron emission from Earth's magnetosphere.

**Lunar photoelectron sheath:** The primary focus of ROLSSES is to measure the near-surface density of the photoelectron sheath. This subject has been extensively studied; however, measurements have never been made on the surface. The figure below, from a publication by W. M. Farrell et al. (JGR, 2013) shows results



from a model of electron sheath evolution during different solar wind environments.

**Hardware:** It is anticipated that ROLSSES will be landed on the lunar surface by a commercial lunar lander in approximately 2 years. We are assembling

electronics to take voltages from the antenna pre-amps and convert them to spectra for down-link. The antenna system will consist of four Stacer antennas, two of which will be one meter from the surface, and mounted in opposed locations to facilitate using them as a dipole. The second dipole will be mounted at a height of 2 meters from the surface.

**Astrophysics and Heliophysics Lunar Radio Astronomy Arrays:** We plan to make measurements of the lunar environment up to 30 MHz, in support of future farside astrophysics radio astronomy arrays, e.g., a Farside lunar Astrophysics Radio Science Instrument for Dark ages cosmology and Exoplanet research (FARSIDE). The Moon provides a quiet radio background by occulting signals from terrestrial transmitters. However, when the FARSIDE array is on the day-side during lunar rotation, it will observe many solar radio bursts. The extended array with ~128 antennas, distributed in an area of 100 kilometers squared, will provide new data on the radio burst mechanisms of type II and type III bursts. Because the radio emission-producing electron beams follow the magnetic field lines, imaging provides insights to structures in the interplanetary magnetic field. Solar Energetic Particle (SEP) events are accompanied by complex type III bursts and intense type II bursts, which thus play a role in space weather alerts. Imaging would be an improvement that would help to locate the radio emission producing electrons, providing additional detail about the SEP source and evolution.

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